

Amendment to the Specification

Delete page 3, lines 13-20, and add, as follows:

It is an object of the present invention to provide a brake apparatus of which travel characteristic can be changed in such a manner as to obtain deceleration (braking force) of a vehicle and travel of the input side ~~which are~~ is equal to those for service braking whatever wheel cylinder pressure is changed in connection with the operation of an additional brake system.

It is another object of the present invention to provide a brake apparatus in which variations of wheel cylinder pressure do not ~~affects~~ affect the input side.

Delete page 9, line 23, to page 10, last line, and add, as follows:

In the brake apparatus of the present invention having the aforementioned structure, the discharge pressure of the pump (hereinafter, sometimes referred to as "pump discharge pressure") is controlled by the braking force control device according to ~~at least either~~ the operational condition for service braking ~~or~~ and the operational condition for another braking different from the service braking. The operation of the travel modifying device is controlled by the controlled pump discharge pressure, thereby modulating the travel of the operational member in braking maneuver. Therefore, the travel of the operational member can remain the same as for the service braking whenever the wheel cylinder pressure is varied relative to the same input according to the operation such as service braking operation, regenerative braking operation, or brake assist operation.

In the present invention, for example, the travel of the master cylinder is modulated for modulating the travel of the operational member.

According to the present invention, the travel of the master cylinder piston can ~~be~~ remain the same as for service braking without being influenced by different operation. However, the input

Q232
applied to the master cylinder piston is varied according to changes in wheel cylinder pressure. Therefore, the present invention is preferably applied to a brake system which can withstand even when the input is varied.

According to the present invention, the travel of the master cylinder piston can be remain the same as for service braking without being influenced by different operations as mentioned above. During this, the input applied to the master cylinder piston is not varied whenever wheel cylinder pressure is varied. Therefore, the brake apparatus of the present invention is suitably applied for various braking operations.

Delete page 15, lines 4-11, and add, as follows:

Q3
Fig. 6 is a sectional view showing a fifth embodiment of the present invention, showing a master cylinder similar to the master cylinder of the third embodiment of the present invention shown in Fig. 3, but incorporated with a vacuum booster;

Fig. 7 is a sectional view showing a sixth embodiment of the present invention, showing a master cylinder similar to the master cylinder of the fifth embodiment of the present invention shown in Fig. 6, but incorporated with a hydraulic booster;

Delete page 17, line 21 to page 18, line 3, and add, as follows:

Q4
Fluid-tightly and slidably received in the first cylindrical member 6 is a cylindrical primary outer piston (corresponding to the second piston of the present invention) 8 which is also fluid-tightly and slidably received in the second cylindrical member 7 and ~~extend~~ extends to protrude in the backward direction from the end of the second cylindrical member 7. The primary outer piston 8 is a stepped piston composed of a large-diameter portion 8a which is fluid-tightly and slidably fitted in the first cylindrical member 6 and a small-diameter portion 8b which protrudes fluid-tightly and slidably from the second cylindrical member 7 and of

which diameter is slightly smaller than that of the large-diameter portion 8a.

Delete page 25, line 13 to page 26, line 11.

Delete page 31, line 22 to page 32, line 5, and add, as follows:

In the MCY 1, since the relation ~~between~~ among the input W, the MCY pressure P_m , and the braking force control pressure P_p (WCY pressure P_w) is given by the Expression (3), the input W is involved in the braking force control pressure P_p (WCY pressure P_w) so that variations in the braking force control pressure P_p (WCY pressure P_w) leads to variation in the input W. Therefore, variations in the pedal travel can be modulated ~~during~~ while the brake control is conducted at the WCY side as mentioned above, but variations in the pedal force can not be modulated.

Delete page 37, line 14 to page 38, line 8, and add, as follows:

While the primary outer piston 8 of the first embodiment is the stepped piston with the outer peripheral step 8e, a primary outer piston 8 of an MCY 1 in this second embodiment has an outer periphery of which diameter is constant from its front end to its rear end without the outer peripheral step 8e. The primary outer piston 8 is held in fluid-tight state relative to the inner periphery of the first cylindrical member 6 by a metal seal 107. As shown in this drawing, the metal seal 107 is provided at a portion ~~as~~ near the front end of the primary outer piston 8 as close as possible. The first cylindrical member 6 has an increased diameter portion 6a formed at a location behind the metal seal 107 when the primary outer piston 8 is in its rear-most position. The increased diameter portion 6a has an inner diameter larger than that of a portion of the first cylindrical member 6 on which the metal seal 107 slides. Since the increased diameter portion 6a is formed, an

annular space 108 having a predetermined axial length is defined between the inner periphery of the cylindrical member 6 and the outer periphery of the primary outer piston 8. Because of the existence of the space 108, the communication between the control pressure chamber 40 and the control pressure inlet 44 is always allowed even when the primary outer piston 8 moves.

Delete page 43, lines 1-10, and add, as follows:

The third and fourth cylindrical members 14, 19 used in the MCY 1 of the second embodiment do not exist in the MCY 1 of the third embodiment. Instead of the third and fourth cylindrical member 14, 19, fifth through seventh cylindrical members 48, 49, and 50 are inserted, in this order, into the axial bore 2a of the housing 2 and are stopped by the first cylindrical member 6 in the longitudinal direction. In this case, the sixth cylindrical member 49 are is fluid-tightly fitted in the axial bore 2a. The first cup seal 15 is disposed between the first and seventh cylindrical members 6 and 50 and the second cup seal 21 is disposed between the fifth and sixth cylindrical members 48, 49.

Delete page 46, lines 14-21, and add, as follows:

The brake system of the fourth embodiment is a brake system employing the MCY 1 of the third embodiment. The brake system of this embodiment includes a hydraulic fluid supply line 59 connected to the first output port 34 for the first brake circuit, and first and second hydraulic fluid supply branches 59L, 59R at the end of the hydraulic fluid supply line 59. The first hydraulic fluid supply branch 59L is connected to a WCY 60 of a front left wheel FL while the second hydraulic fluid supply branch 59R is connected to a WCY 61 of a front right wheel FR.

Delete page 48, line 21 to page 49, line 4, and add, as follows:

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9
In the second brake circuit connected to the second output port 38 for supplying and discharging hydraulic fluid to WCYs 80, 81 of rear wheels RR, RL, identical valves, pumps, and pressure sensors to the first brake circuit are employed in the same manner, except the first pressure sensor 78. Such identical component parts are designated with the same reference ~~numeral~~ numerals used in the first brake circuit, but are differentiated therefrom by means of additional marks "a", thus omitting the detail description of such component parts.

Delete page 54, lines 4-13, and add, as follows:

9, 10
During a failure of the motor M 82 or the pump(s) 75, 75a, no pressure is intensified by the pump 75, 75a. Accordingly, the controller retains the selector valve(s) 62, 62a of at least the brake circuit affected by the failure in the communication position. As a result, MCY pressure developed depending on the forward movement of the primary inner piston 9 is directly transmitted to the WCYs, thereby securely actuating the wheel brakes of the brake circuit whenever a failure occurs. The brake characteristic in this case is that the WCY pressure is smaller than that for service braking and the pedal travel is shorter than that for service braking because no pressure is intensified by the pump(s).

Delete page 58, line 16 to page 59, line 1, and add, as follows:

9, 11
The MCY 1 of the fifth embodiment is also connected to a brake system as shown in Fig. 4 described above, but not shown in Fig. 6. Therefore, as the MCY 1 of the fifth embodiment ~~develop~~ develops MCY pressure, the pumps 75, 75a are energized in the same manner as the brake system of the fourth embodiment, so as to intensifying the MCY pressure to control WCY pressure according to the current operating condition such as the service braking operation, the regenerative brake coordination, or the brake assist control. Then,

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a10
the controlled WCY pressure is introduced into the control pressure chamber 40 of the MCY 1, whereby the pedal travel remains the same as in the service braking mode.

Delete page 62, line 17 to page 63, line 3, and add, as follows:

12
a
In the MCY 1 of any of the aforementioned embodiments, the primary piston is composed of two members: the primary outer piston 8 and the primary inner piston 9 which are slidable to each other. In the MCY 1 of the seventh embodiment, however, as schematically illustrated in Fig. 9, a primary piston 128 is composed of a single member just like a conventional tandem master cylinder of a know type. It should be noted that, in the inoperative state of the MCY 1, first and second MCY pressure ~~chamber~~ chambers 32, 37 of the MCY 1 are allowed to communicate with a reservoir 135 through first and second reservoir connecting ports 27, 31 in the same manner as the conventional MCY or the MCY 1 of any of the aforementioned embodiments.

Delete page 68, line 23 to page 69, line 3, and add, as follows:

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a
The construction of the MCY 1 and the brake system of the seventh embodiment ~~is~~ are otherwise the same as those of the fourth embodiment.

The pedal travel modulating device 129 of the seventh embodiment having the aforementioned construction can exhibit the following effects as ~~compare~~ compared to the aforementioned embodiments.

Delete page 72, lines 23-24, and add, as follows:

14
a
Fig. 11 is a sectional view showing a pedal travel modulating device 129 of a an eleventh embodiment of the present invention.

Delete page 80, lines 20-23, and add, as follows:

Q15
A₃ : effective pressure receiving area of a large-diameter portion 112a of the input shaft 112 and effective pressure receiving area of the primary piston 9 ~~where receive~~ which receives the pump discharge pressure P_p;

Delete page 92, line 13 to page 93, line 5, and add, as follows:

Q16
As shown in Fig. 18, the control pressure inlet 44 is always connected with a discharge side of a pump 45. Therefore, the discharge side of the pump 45 is always connected to the control pressure chamber 40. The control pressure inlet 44 and the reservoir 135 are connected via a bypass line 168 bypassing the pump 75, besides a line provided with the pump 75. In the bypass line 169, a pressure control valve 169 as a braking force controller is provided. The pressure control valve 169 has a communication position ~~where~~ which allows the communication between the control pressure inlet 44 and the reservoir 135 when the master cylinder 1 is inoperative (when the brake pedal is not depressed) and a fluid pressure control position ~~where~~ which controls the fluid pressure of the control pressure chamber 40 (the pump-discharge pressure) when the master cylinder 1 is operative (when the brake pedal is depressed). Thus, the master cylinder 1 of the sixteenth embodiment is adapted to be in the out-line type in which the primary piston 154 is operated by the pump discharge pressure supplied into the control pressure chamber 40 after adjusted by the pressure control valve 169 and then outputs MCY pressure.

Delete page 94, lines 23-24, and add, as follows:

Q17
A₁ : effective pressure receiving area of the input shaft 112 ~~where~~ which receives the pump discharge pressure P_p;

Delete page 97, lines 4-7, and add, as follows:

Q18
A₂ : effective pressure receiving area of the primary piston 154 ~~where~~ which receives the pump discharge pressure P_p;

18
A3 : effective pressure receiving area of the primary piston 154
where which receives the MCY pressure P_m ;

Delete page 98, line 20 to page 9, line 8, and add, as follows:

19
As the brake pedal is depressed for service braking, the pedal force or pedal travel is detected and is inputted into the controller. Then, the controller energizes the pump 75 and shifts the pressure control valve 169 into the fluid pressure control position. Therefore, the pump 75 discharges hydraulic fluid to the control pressure chamber 40 so as to increase the fluid pressure of the control pressure chamber 40 (the pump discharge pressure). The pump discharge pressure is controlled by the pressure control valve 169. At this point, the controller ~~set~~ sets the pressure control valve 169 to increase or reduce the fluid pressure in proportion to the pedal force or pedal travel so as to obtain pump discharge pressure proportional to the pedal force or pedal travel. Since the regenerative braking is not applied, the controller controls the pressure control valve 169 to obtain relatively great pump discharge pressure.

Delete page 107, line 16 to page 108, last line, and add, as follows:

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According to the ~~aspect of claims 4 through 10~~ invention, the brake system can not only modulate or compensate the travel of the master cylinder piston to remain the same as that in the service braking mode when the wheel cylinder pressure is varied, but also control the input applied to the master cylinder piston to remain the same even when the wheel cylinder pressure is varied. Therefore, the master cylinder according to ~~claim 4~~ the invention can be suitably applied for various brake operational modes.

According to the ~~aspect of claims 7 through 12~~ invention, the pedal travel modulating device is positioned out of the central axis of the primary piston of the master cylinder, thereby

simplifying the construction of such master cylinder and pedal travel modulating device, improving the assembly work, and reducing the cost involved. The simplified construction leads to decrease in number of portions producing frictional force of the pedal travel modulating device, thus improving the accuracy of travel control of the pedal travel modulating device.

According to the ~~aspect of claim 13~~ invention, in the event of failure of the pump, the master cylinder pressure is introduced directly to the wheel cylinders, thereby securely actuating the wheel brakes with the master cylinder pressure.

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According to the ~~aspect of claim 14~~ invention, the servo ratio of the brake pressure intensifying device can be set to be smaller than the normal servo ratio for service braking. Therefore, the brake system of the present invention can employ a brake pressure intensifying device of reduced size.

According to the ~~aspect of claim 15~~ invention, in the event of failure of pressure source of the brake pressure intensifying device, the operating force of the brake operational member can be directly transmitted to the master cylinder piston without magnification to operate the master cylinder piston. Accordingly, even in the event of such failure of pressure source, the brake system can securely develop master cylinder pressure in the master cylinder pressure chamber.
